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Specification for Standardized Ultrasonic Welding Test Specimen for Thermoplastics

Prepared by
AWS Committee on Joining of Plastics and Composites

Under the Direction of
AWS Technical Activities Committee

Approved by
AWS Board of Directors

Abstract

This specification outlines the requirements for the ultrasonic welding test sample for thermoplastics and its welding and testing. In order to minimize variations, the geometry for the standard test sample is defined in detailed figures including tolerances on critical dimensions that may affect its weldability.

This specification can be used for but not be limited to the following investigations:

Thermoplastic Ultrasonic Weldability Studies;
Thermoplastic Ultrasonic Welding Optimizations; and
Scientific Studies on the Ultrasonic Welding of Thermoplastics.

Data collection of welding variables is divided into three levels. Level three data recording requires the highest precision of data collection and, consequently, is the most time intensive. Level two data recording requires moderate data collection for more practical investigations. Level one data recording is the least stringent. These three levels are included in order to recognize the varying levels of precision required within the plastic welding community.



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1. Scope

1.1 This specification outlines the requirements for a standard ultrasonic welding test sample for thermoplastics and its welding and testing.

1.2 As used in this specification, the word **shall** denotes a requirement; the word **should** denotes a guideline or recommendation; and the word **may** denotes a choice.

1.3 This standard makes use of both the International System of Units (SI) and U.S. Customary Units. The measurements are not exact equivalents; therefore each system must be used independently of the other without combining in any way. The standard with the designation G1.2M:1999 uses SI Units. The standard with the designation G1.2:1999 uses U.S. Customary Units. The latter are shown in appropriate columns in tables and figures, and within parentheses () when used in the text.

2. Referenced Documents

AWS G1.1 *Guide to the Ultrasonic Assembly of Thermoplastics*

3. Definitions

actuator. The unit that houses the converter, booster, and horn assembly in a rigid mounting allowing it to move up and down either mechanically or pneumatically to apply a predetermined pressure on the workpiece.

amplitude. The peak to peak displacement of the horn at its work face as expressed in μm or in.

booster. A one-half wavelength long resonant metal section mounted between the converter and horn, it may have a change in cross-sectional area between the

input and output surfaces. It usually mechanically increases or decreases the amplitude of the system, or acts as a coupling bar.

conditioned. Any condition other than dry-as-molded (i.e., moistened, aged, annealed, etc.).

converter. An electro-mechanical device which transforms electrical energy to mechanical energy.

coupling bar. A booster with unity gain, i.e., does not change the amplitude (1:1 Gain Ratio).

displacement. The total collapse of the part during the welding process, expressed in mm or in.

down speed. The rate of travel of the actuator from the home position to the part. Expressed in mm/s or in./s.

dry-as-molded. The moisture condition of the test sample as it is ejected from the mold.

energy. In welding, energy required to melt the plastic equals the power delivered multiplied by the time power is applied. Measured in watt seconds or joules.

energy director butt joint. A joint that contains a triangular-shaped projection of plastic material at the joint interface of a plastic part that concentrates the ultrasonic energy against a flat surface (see Figure 5).

far field welding. Configuration where the joint surface plane is typically more than 6 mm (0.25 in.) from the plane of horn contact with the workpiece.

fixture. A device for locating and supporting the workpiece in position for assembly.

flash. Material displaced from the joint area as a result of welding.

frequency. The number of complete oscillations per second, or cycles produced by the converter, booster, and horn. Expressed in Hertz (Hz) or kilohertz (kHz).